

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

TMA1211 – DISCRETE MATHEMATICS AND PROBABILITY (All sections / Groups)

9 MARCH 2020
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **6 pages** only excluding the cover page with **5 Questions** and an **Appendix**.
2. Attempt **ALL FIVE (5)** questions.
3. Please write your answers in the Answer Booklet provided, and **start each question on a new page**.
4. Show all steps.
5. Statistical tables and formulas are provided and attached in Appendix.

Answer ALL FIVE (5) questions.

QUESTION 1 (10 marks)

a. Given the following scenario:

“If Liz scores 90 marks for Discrete Mathematics, she gets an A. If she gets an A, her father will either buy her a desktop computer or a notebook. If her father buys her a desktop computer, she will study harder. If she gets the notebook, she will bring it to the campus. Liz scores 90 marks but she does not study harder. As a conclusion, she gets a desktop computer.”

Let P : Liz scores 90 marks.

Q : She gets an A.

R : Father buys her a desktop computer.

S : Father buys her a notebook.

T : She gets the computer.

U : She study harder.

V : She gets the notebook.

W : She bring the notebook to campus.

Prove whether the conclusion is valid or invalid, by using **formal reasoning** (without using a truth table).

What should the valid conclusion be if the above conclusion is not valid?

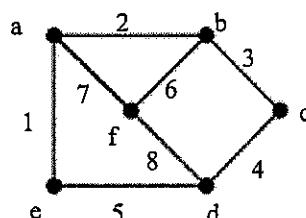
(5 marks)

b. Let R be the relation on $A = \{3, 4, 5, 6\}$ defined by $(x, y) \in R$ if $xy \geq 9$, $x, y \in A$.

- Represent R in a zero-one matrix, M_R . (0.5 mark)
- Determine whether R is reflexive, symmetric, anti-symmetric and/or transitive. Explain your answer. (4 marks)
- Is R an equivalence relation or a partial ordering? Why? (0.5 mark)

QUESTION 2 (10 marks)

a. For the graph below,



- find the degree of each vertex. (1 mark)
- verify that Handshaking Lemma is true for this graph. (1.5 marks)
- draw an adjacency matrix and an incidence matrix for the graph above. (2 marks)

Continued.....

b. Let $*$ be the operation on the set R of real numbers defined by $a * b = |a|^b$.

- Is $(R, *)$ associative? (2.5 marks)
- Is $(R, *)$ commutative? (1.5 marks)

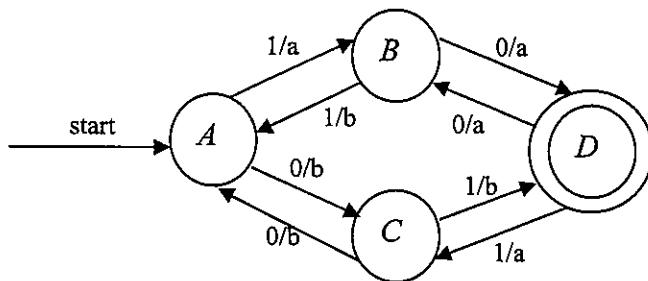
c. If $S = \{1, 2, 3\}$ and $a * b = 2a - b$, determine whether S is closed under $*$. (1.5 marks)

Question 3 (10 marks)

a. The sequence of a function, $f(n) = 2n + 5$, is 5, 7, 9, 11, Find the recursive definition of the given sequence by stating its basis case, $f(0)$, and recursive case. (1.5 marks)

b. Use induction to prove that $4+9+14+19+\dots+(5n-1)=\frac{n}{2}(3+5n)$ for all natural numbers n . (3.5 marks)

c. Given the following state diagram, find



- set S of all states. (0.5 mark)
- set I of all inputs. (0.5 mark)
- set O of all outputs. (0.5 mark)
- the initial state and set F of the final/accepting state. (0.5 mark)
- the state table of the state machine. (1 mark)

Then, copy the table below and complete it on your answer script. (2 marks)

Input string	Output string	Last State	Accepted? (Yes/ No)
110001			
	ababaa		

Continued.....

QUESTION 4 (10 marks)

a. You are preparing for a wedding and you need to pick out tuxedos for the groomsmen. There are 3 categories (jackets, vest and tie, and shirt colours) provided in Tuxedo Warehouse for you to build the tuxedos. The Tuxedo Warehouse manager allows you to build the tuxedo from two jackets, three vest and tie combinations, and three shirt colours. How many total ways are there to build the tuxedos? (1 mark)

b. A Discrete Mathematics class has 30 students. 5 students are required to do a presentation. Find the total number of ways to get 5 students to do a presentation. (1 mark)

c. Mr. John will conduct an Information Technology workshop for his clients. There are 3 Cryptography modules, 4 Networking modules and 5 Big Data Analysis modules for him to randomly select 3 modules to run the workshop. What is the probability that

- exactly two of the selected modules are Networking? (1.5 marks)
- no Cryptography module is selected? (1.5 marks)

d. A sample of 200 students in Information Technology course at a university was asked to indicate his/her gender and eye colour in a survey. The following table summarizes the results of the survey.

		Eye colour			
		Brown (Br)	Blue (B)	Green (G)	Total
Gender	Male (M)	50	40	20	110
	Female (F)	40	40	10	90
	Total	90	80	30	200

Suppose that one of these student is randomly selected, find the probability that the selected student

- is a female. (1 mark)
- is a female or has brown eyes. (2 marks)
- has green eyes given that the student is a male. (2 marks)

QUESTION 5 (10 marks)

a. According to a survey, 30% of Malaysian mobile phone users are using phones other than smart phone. Assume that this result holds true for the current Malaysian population of all mobile phone users. 15 Malaysian mobile phone users are randomly selected.

- Why can binomial distribution be used in this situation? State two reasons. (1 mark)
- By using the statistical tables, find the probability that between 4 and 10 of mobile phone users are using smart phone. (2 marks)

Continued.....

b. The joint probability distribution of the random variables X and Y is as follows.

$P(x,y)$		y		
		0	1	2
x	1	0.04	0.21	k
	2	0.10	k	0.23
	5	k	0.10	k

i. Find the value of k . (1 mark)

If $k = 0.08$,

ii. compute $P(1 < X < 5, Y > 0)$. (1 mark)
 iii. find $E(XY)$. (1.5 marks)

c. Given the joint probability density function of X and Y as below.

$$f(x,y) = \begin{cases} \frac{1}{9}xy & , \quad 0 < x < 1, 0 < y < 6 \\ 0 & , \quad \text{elsewhere} \end{cases}$$

i. Find the marginal probability density function of X . (2 marks)

ii. If $E(X) = \frac{2}{3}$, $E(Y) = 4$ and $E(XY) = \frac{8}{3}$, are X and Y correlated?

(1.5 marks)

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